AMENDMENTS TO THE DRAWINGS

In Figs. 34 and 45-46, reference numeral "75(5)" has been amended to "72(5)". Therefore, please replace the attached drawing sheets for the original drawing sheets including Figs. 34 and 45-46.

Attachments: Replacement Drawing Sheets for Fig. 34 and 45-46

REMARKS

By this amendment, the specification has been editorially amended, Fig. 34 and 45-46 have been amended, claims 6, 14-28 and 47-50 have been cancelled and claims 1-5, 7-11, 13, 29-33, 35-36, 38-43 and 45-46 have been amended in the application. Currently claims 1-5, 7-13, 29-46 and 51-54 are pending in the application.

Claims 16-26, 28 and 29-54 were rejected under 35 USC 112, second paragraph, as being indefinite. The Examiner stated that claims 16, 17 and 19-26 were directed to claim 1 but these claims lacked antecedent basis. Also, the Examiner stated that claim 18 was dependent on claim 4 but this claim lacked antecedent basis. Also, the Examiner stated that claim 28 was directed to claim 14 but this claim lacked antecedent basis. Further, the Examiner stated that claims 47-50 referred to independent claim 45 and referred to a light-transforming member, which was not recited in independent claim 45. Since claims 16-26, 28 and 47-50 have been cancelled from the application, it is respectfully submitted that these rejections are now moot.

The Examiner also stated that independent claims 29, 45 and 46 were unclear as written. By this amendment, independent claims 29 and 45 have been amended to recite "the inclined side surfces

of the structured portion are defined by first side surfaces and second side surfaces, a width of each first side surfaces increases from a lower surface side to an upper surface side, and a width of each second side surfaces increases from the upper surface side to the lower surface side". Specifically, as shown in Fig. 53A of the present invention, the width of the first side surfaces 10x increases from the lower surface 10g side to the upper surface 10f side. On the other hand, the width of the second side surfaces 10y increases from the upper surface 10f side to the lower surface 10g side (see page 3, line 14 - page 4, line 5 of the specification).

It is respectfully submitted that this rejection has been overcome by these amendments and it should be withdrawn.

Claims 14-16, 20, 21 and 23-26 were rejected under 35 USC 102(b) as being anticipated by Thiebeault et al. (U.S. Patent No. 6,410,942). Also, claims 27 and 28 were rejected under 35 USC 103(a) as being obvious over Thibeault et al. in view of Nuyen (U.S. Patent No. 5,593,917) and further in view of Okazaki (U.S. Patent No. 5,814,837). Also, claims 17-18 and 22 were rejected under 35 USC 103(a) as being obvious over Thiebeault et al. in view of Krames et al. (U.S. Patent No. 6,229,160). Further, claim 19 was rejected under 35 USC 103(a) as being obvious over

Thibeault et al. in view of Steigerwald et al. (U.S. Patent Application Publication No. 2003/0230754). Since claims 14-28 have been cancelled from the application, it is respectfully submitted that these rejections are now moot.

Independent claim 1 and dependent claims 2, 4 and 9-12 were rejected under 35 USC 103(a) as being obvious over Krames in view of Kato et al. (U.S. Patent Application Publication No. 2002/0017651). Also, dependent claim 3 was rejected under 35 USC 103(a) as being obvious over Krames et al. in view of Kato et al. and further in view of Okazaki. Also, dependent claims 5-8 were rejected under 35 USC 103(a) as being obvious over Krames et al. in view of Kato and further in view of Okuyama et al. (U.S. Patent Application Publication No. 2002/0117677). Further, dependent claims 13 and 34 were rejected under 35 USC 103(a) as being obvious over Krames et al. in view of Kato et al. and further in view of Thibeault et al. Further, independent claim 29 and dependent claims 33, 35 and 41 were rejected under 35 USC 103(a) as being obvious over Krames et al. Further, dependent claims 36, 39 and 42-44 were rejected under 35 USC 103(a) as being obvious over Krames et al. in view of Thiebeault et al. Further, dependent claims 37, 38 and 40 were rejected under 35 USC 103(a) as being obvious over Krames et al. in view of Thiebeault et al.

and further in view of Steigerwald et al. Further, independent claim 45 was rejected under 35 USC 103(a) as being obvious over Thiebeault et al. Further, dependent claims 46-50 were rejected under 35 USC 103(a) as being obvious over Thibeault et al. in view of Sano et al. (US 2003/0141506).

These rejections are respectfully traversed in view of the amendments to the claims and the remarks below.

The present invention relates to semiconductor light-emitting devices, and particularly to a light-emitting device including a nitride semiconductor containing nitrogen, and to a method for manufacturing the same (see page 1, lines 6-16 of the specification).

A nitride semiconductor light-emitting device according to Embodiment 1 of the present invention includes: a structured portion 10 defining a luminescent region and having a inclined side surface 10a inclined inward; and n electrode 21 in ohmic contact with an n-type contact layer 12 exposed at the inclined side surface 10a, as shown in Figs. 1 and 2 (see page 36, lines 4-9 of the specification).

In Embodiment 1, the n electrode 21 is continuously formed from the surface of the sapphire substrate 1 exposed at the corner of the structured portion 10 to the inclined side surface 10a of

the structured portion 10, and thus establishes an ohmic contact with the n-type contact layer 12 exposed at the inclined side surface 10a, as shown in Figs. 1 and 2.

On the other hand, the p electrode includes an over-surface electrode 31 and a p pad electrode 32. The over-surface electrode 31 is provided over substantially the entire surface of the p-type contact layer 16, which is the uppermost layer of the structured portion 10, and the p pad electrode 32 is disposed on the over-surface electrode 31 in a region opposing the n electrode 21 (opposing corner) (see page 36, lines 4-16 of the specification).

Fig. 17 is a plan view of the arrangement of a nitride semiconductor light-emitting device according to Embodiment 6, and Fig. 18 is a plan view of one of the structured portions 310.

In the nitride semiconductor light-emitting device of Figs. 17-18, the structured portions 310 are formed in a circular shape, and arranged such that their centers are aligned in a matrix manner. The layered structure of each of structured portions 310 is the same as that of other embodiments, and its inclined side surface is inclined inward (inclined periphery 310a), and the section of the structured portion has a trapezoidal shape whose upper side is defined as the upper base, as shown in Figs. 19A and 19B.

The n ohmic electrode (contact portion) 321a of each of the structured portions 310 is formed on the entire circumference of the inclined side surface 310a so as to come into ohmic contact with the n contact layer exposed at the surface of the inclined side surface 310a. In addition, n connecting pad electrodes (interconnect portion) 321b are disposed on the substrate between the structured portions 310, and the contact portions 321a of each structured portion 310 is connected to four adjacent interconnect portions 321b.

Specifically, in the nitride semiconductor light-emitting device of Figs. 17-18, the n electrode 321 includes the contact portions 321a and the interconnect portions 321b.

Also, the over-surface electrode 331 is provided over substantially the entire upper surface (upper surface of the p contact layer) of each structured portion 310, and a circular p pad electrode 332 is formed in the center of the over-surface electrode 331.

After forming the contact portions 321a, interconnect portions 321b, over-surface electrodes 331, and p pad electrodes 332 as described above, an insulating layer 371 is formed to cover the entire device except the upper surfaces of the interconnect portions 321b, their surroundings, and the p pad electrodes 332.

Then, p connecting electrodes 361 are formed to connect the p pad electrodes 332 of the structured portions 310 to each other. The p connecting electrode 361 includes a pad connecting portion 361b connected to the upper surface of the p pad electrode 332 and a connecting portion 361a connecting the pad connecting portion 361b to another pad connecting portion.

The nitride semiconductor light-emitting device having the above-described structure according to Figs. 17-19B can prevent the electrodes from absorbing light and exhibit increased light extraction efficiency, as in Embodiment 1 (see page 51, line 10 - page 53, line 4 of the specification).

The structured portion 10 of the device has the lower surface 10a and the upper surface 10f with a smaller area than that of the lower surface 10g, and the side surfaces 10x between the dotted chain lines 10x-1 and 10x-2 define the corners of the structured portion 10 of the device and have a width increasing toward the upper surface 10f from the lower surface 10g, as shown in Figs. 53A and 53C. On the other hand, the side surfaces 10y are formed so as to have a width decreasing toward the upper surface. Thus, the widths of the side surfaces 10x and 10y are varied in reverse to each other in the height direction (toward the upper surface) of the structured portion, that is, the width of the side surfaces

10x is increased and the width of the side surfaces 10y is reduced (see page 3, line 17 - page 4, line 5 of the specification).

By this amendment, independent claim 1 has been amended to recite "each of the structured portions has at least an inclined side surface at which the surface of the n-type semiconductor layer is exposed and a lower surface with a larger width than a width of the upper side thereof in sectional view, and the n-electrode has a plurality of contact portions disposed on the surface of the n-type semiconductor layer in each of the structured portions".

Also, independent claims 29 and 45 have been amended to recite "the inclined side surfces of the structured portion are defined by first side surfaces and second side surfaces, a width of each of the first side surfaces increases from a lower surface side to an upper surface side, and a width of each of the second side surfaces increases from the upper surface side to the lower surface side".

These features are not shown or suggested by Krames et al., Kato et al., Okazaki, Okuyama et al., Thibeault et al., Steigerwald et al., Sano et al. or any combination of these references.

Krames et al. relates to the process of designing and fabricating semiconductor light-emitting devices (see col. 1, lines 6-10). Krames et al. disclose that in Fig. 2, the light

emitting device has a plurality of p- and n-type doped epitaxial layers 10, an active region 11, a transparent substrate 12, a window layer 13, top and bottom electrical ohmic contacts 14, 15, sidewalls 16, and a top surface 17.

Krames et al. also disclose that in Fig. 6, an inverted truncated-cone has a base that is circular (in general, elliptical) (see col. 6, lines 40-43).

Krames et al. also disclose that in Fig. 11, the electrical contacts to both sides of the p-n junction are formed on the bottom mounting surfaces of the device (see col. 9, lines 8-10).

Krames et al. do not disclose that each of the structured portions has at least an inclined side surface at which the surface of the n-type semiconductor layer is exposed and a lower surface with a larger width than a width of the upper side thereof in sectional view, and the n-electrode has a plurality of contact portions disposed on the surface of the n-type semiconductor layer in each of the structured portions as claimed in independent claim 1.

Also, Krames et al. do not disclose that the inclined side surfces of the structured portion are defined by first side surfaces and second side surfaces, a width of each of the first side surfaces increases from a lower surface side to an upper

surface side, and a width of each of the second side surfaces increases from the upper surface side to the lower surface side as claimed in independent claims 29 and 45.

Also, applicants respectfully submit that independent claim 1 defines a plurality of structured portions having a contact portion of the n-electrode for the ohmic contact with n-type layer respectively, and the inclined side surface of the structured portions for light reflection and ohmic contact. Thus, the light emitting area of the LED would be enlarged with integration of the structured portions, while light emitted from the structured portions would be reflected and extracted, therefore, it can be effectively extracted and outputted from the LED device.

Specifically, Krames et al. disclose that the light emitting device has an inclined periphery in Figs. 2, 6 and 11. However, Krames et al. do not disclose an electrode having contact with an inclined side surface thereof. In other words, the inclined side surface is not provided for ohmic contact with the electrode but for light reflection only. Thus, it is clear that the differences between the amended independent claim 1 and Krames et al. are as follows: 1) inclined side surface in amended claim 1 includes ohmic contact; and 2) a plurality of structured portions are

integrated with the n-electrode having the connection portions to the respective structured portions.

As for independent claims 29 and 45, the Examiner stated that regarding claim 35, it would have been obvious to reverse the radius of curvature of the upper and lower surfaces to produce smooth sidewalls according to the teachings of Krames (see col. 6, lines 28-31). However, as shown in Fig. 52 of the present invention, according to routine manner, all of side surfaces have the same configuration with a narrow upper surface and wide bottom surface, because the first and second side surfaces with reverse configuration as shown in Fig. 53 may be manufactured by the special process with the certain configuration mask (M1) as described in Figs. 20A and 20C.

For these reasons, it is believed that Krames et al. do not show or suggest the presently claimed features of the present invention. Applicants also submit that Kato et al. do not make up for the deficiencies in Krames et al.

Kato et al. relate to a white light emission diode useful as a back light for various devices such as an illuminator, indicator, and display (see page 1, paragraph [0002]).

Kato et al. disclose that in FIG. 1, the white light emission diode has substrate 21, n-type semiconductor layer 22, p-type

semiconductor layer 23, p-type ohmic electrode 24, insulating film 25, n-type ohmic electrode 26, bonding pad for mounting 27, eutectic electrodes 28, insulating substrate 29, anode trip electrode 30, cathode trip electrode 31, wavelength converting element 32, gold wire 33, and molded resin 34 (see page 2, paragraph [0032]).

Kato et al. do not disclose that each of the structured portions has at least an inclined side surface at which the surface of the n-type semiconductor layer is exposed and a lower surface with a larger width than a width of the upper side thereof in sectional view, and the n-electrode has a plurality of contact portions disposed on the surface of the n-type semiconductor layer in each of the structured portions as claimed in independent claim 1.

Also, Kato et al. do not disclose that the inclined side surfces of the structured portion are defined by first side surfaces and second side surfaces, a width of each of the first side surfaces increases from a lower surface side to an upper surface side, and a width of each of the second side surfaces increases from the upper surface side to the lower surface side as claimed in independent claims 29 and 45.

For these reasons, it is believed that Kato et al. do not show or suggest the presently claimed features of the present invention. Applicants also submit that Okazaki et al. do not make up for the deficiencies in Krames et al. and Kato et al.

Okazaki relates to a light-emitting device of surface-packaging type and its manufacturing method, which is used as a light source for various display panels, a backlight for liquid crystal displays and a light source for lighting switches.

Okazaki discloses that in Figs. 1(a) and 1(b), the light-emitting device 10 is provided with an insulating substrate 17 of an oblong shape and an LED (Light-Emitting Diode) chip 14 that is disposed on the insulating substrate 17. The insulating substrate 17 is made of glass epoxy resin, composite, or other materials. Semi-cylindrical recessed portions 11' are provided at the respective ends of the insulating substrate 17 in the lengthwise direction (see col. 5, lines 62 - col. 6, line 4).

Okazaki does not disclose that each of the structured portions has at least an inclined side surface at which the surface of the n-type semiconductor layer is exposed and a lower surface with a larger width than a width of the upper side thereof in sectional view, and the n-electrode has a plurality of contact portions disposed on the surface of the n-type semiconductor layer

in each of the structured portions as claimed in independent claim 1.

Also, Okazaki does not disclose that the inclined side surfces of the structured portion are defined by first side surfaces and second side surfaces, a width of each of the first side surfaces increases from a lower surface side to an upper surface side, and a width of each of the second side surfaces increases from the upper surface side to the lower surface side as claimed in independent claims 29 and 45.

For these reasons, it is believed that Okazaki does not show or suggest the presently claimed features of the present invention. Applicants also submit that Okuyama et al. do not make up for the deficiencies in Krames et al., Kato et al. and Okazaki.

Okuyama et al. relates to semiconductor light-emitting devices and processes for producing same (see page 1, paragraph [0002]). Okuyama et al. show in Figs. 53A and 53B a silicon-doped GaN layer 51. Also, an opening is made in the masking layer 52 on the sapphire substrate 50. This opening is close to one side of the substrate 50. In this opening, the n-electrode 100 of Ti/Al/Pt/Au is formed by vapor deposition. This n-electrode 100 supplies current to the region composed of a plurality of hexagonal pyramids. The p-electrode 101 of Ni/Pt/Au or

Ni(Pd)/Pt/Au is formed by vapor deposition. The p-electrode 101, covering a large area, permits each device to emit a strong light. These devices function as a lighting system if they are given the same potential, or these devices function as an image display unit if the p-electrodes 101 are given independent signals (see page 26, paragraph [0340]).

Okuyama et al. also disclose that selective growth is carried out so as to form the n-type (Al)GaN layer 204 as the crystal grown layer in the window region 203, as shown in FIG. 65. This n-type (Al)GaN layer 204 also functions as a cladding layer, and it takes the shape of an approximately hexagonal pyramid (see page 29, paragraph [0362]).

Okuyama et al. do not disclose that each of the structured portions has at least an inclined side surface at which the surface of the n-type semiconductor layer is exposed and a lower surface with a larger width than a width of the upper side thereof in sectional view, and the n-electrode has a plurality of contact portions disposed on the surface of the n-type semiconductor layer in each of the structured portions as claimed in independent claim 1.

Also, Okuyama et al. do not disclose that the inclined side surfces of the structured portion are defined by first side

surfaces and second side surfaces, a width of each of the first side surfaces increases from a lower surface side to an upper surface side, and a width of each of the second side surfaces increases from the upper surface side to the lower surface side as claimed in independent claims 29 and 45.

Also, applicants respectfully submit that semiconductor light-emitting devices of Okuyama et al. are only applied for the LED having a spread layer. Specifically, Okuyama et al. disclose a plurality of layered portions 204 emitting light in Fig. 65. However, as shown in Fig. 53 of Okuyama et al., a first region includes silicon-doped GaN layer portions 53 and 54 covered with a common p-electrode 101, and a second region has one n-electrode 100 apart from the first region, which electron injected from the n-electrode spread in combination with the underlying layer 51.

In contrast, the present invention employs integrated structured portions as light emitting portions in combination with the n-electrode which has a plurality of contact portions for the light emitting portions. Accordingly, it is not necessary to do current spreading with the above-mentioned underlying layer. In addition, these technical features of the present invention, namely providing a plurality of contact portions for the respective structured portions, provide a high density integration

of light emitting portions and uniform current injection for each light emitting portion.

For these reasons, it is believed that Okuyama et al. do not show or suggest the presently claimed features of the present invention. Applicants also submit that Thibeault et al. do not make up for the deficiencies in Krames et al., Kato et al., Okazaki, and Okuyama et al.

Thibeault et al. relate to light emitting diodes and more particularly to new structures for enhancing their light extraction (see col. 1, lines 11-13).

Thibeault et al. disclose that Figs. 1-7 and 9-15 disclose a first spreading layer 20, 34, 56, 106.

Thibeault et al. do not disclose that each of the structured portions has at least an inclined side surface at which the surface of the n-type semiconductor layer is exposed and a lower surface with a larger width than a width of the upper side thereof in sectional view, and the n-electrode has a plurality of contact portions disposed on the surface of the n-type semiconductor layer in each of the structured portions as claimed in independent claim 1.

Also, Thibeault et al. do not disclose that the inclined side surfces of the structured portion are defined by first side

surfaces and second side surfaces, a width of each of the first side surfaces increases from a lower surface side to an upper surface side, and a width of each of the second side surfaces increases from the upper surface side to the lower surface side as claimed in independent claims 29 and 45.

As discussed above, applicants respectfully submit that the light emitting diodes of Thibeault et al. are only applied for the LED having a spread layer. Specifically, Thibeault et al. disclose current spreads in the first spread layer.

In contrast, the present invention employs integrated structured portions as light emitting portions in combination with the n-electrode having a plurality of contact portions for the light emitting portions. Accordingly, it is not necessary to use current spreading with the above-mentioned underlying layer. In addition, these technical features of the present invention, namely providing a plurality of contact portions for the respective structured portions, provide a high density integration of light emitting portions and uniform current injection for each light emitting portion.

For these reasons, it is believed that Thibeault et al. do not show or suggest the presently claimed features of the present invention. Applicants also submit that Steigerwald et al. do not

make up for the deficiencies in Krames et al., Kato et al., Okazaki, Okuyama et al. and Thibeault et al.

Steigerwald et al. relate to light emitting diodes and more specifically to contacts for light emitting diodes (see page 1, paragraph [0001]). Steigerwald et al. disclose that FIG. 1 illustrates an example of a large area III-nitride flip chip light emitting device. Because of the high resistivity of the p-type layers, III-nitride light emitting devices employ a metal layer overlying the p-type layers to provide p-side current spreading (see page 2, paragraph [0024]).

Steigerwald et al. do not disclose that each of the structured portions has at least an inclined side surface at which the surface of the n-type semiconductor layer is exposed and a lower surface with a larger width than a width of the upper side thereof in sectional view, and the n-electrode has a plurality of contact portions disposed on the surface of the n-type semiconductor layer in each of the structured portions as claimed in independent claim 1.

Also, Steigerwald et al. do not disclose that the inclined side surfces of the structured portion are defined by first side surfaces and second side surfaces, a width of each of the first side surfaces increases from a lower surface side to an upper

surface side, and a width of each of the second side surfaces increases from the upper surface side to the lower surface side as claimed in independent claims 29 and 45.

For these reasons, it is believed that Steigerwald et al. do not show or suggest the presently claimed features of the present invention. Applicants also submit that Sano et al. do not make up for the deficiencies in Krames et al., Kato et al., Okazaki, Okuyama et al., Thibeault et al. and Steigerwald et al.

Sano et al. relate to a nitride semiconductor element with a supporting substrate used for a light-emitting device such as a light emitting diode (LED), a laser diode (LD), etc., a photoreceptor such as a solar cell, a photo sensor, etc., an electronic device such as a transistor, a power device, etc., and a method for producing thereof. An attaching structure is employed as one of the methods for producing (see page 1, paragraph [0002]).

Sano et al. disclose that the nitride semiconductor element includes a conductive layer, a first terminal, a first conductive type nitride semiconductor layer interposing the first terminal and a first insulating protect layer between the conductive layer and thereof, a nitride semiconductor with a light-emitting layer,

and a second terminal, on a supporting substrate (see page 10, paragraph [0107]).

Sano et al. do not disclose that each of the structured portions has at least an inclined side surface at which the surface of the n-type semiconductor layer is exposed and a lower surface with a larger width than a width of the upper side thereof in sectional view, and the n-electrode has a plurality of contact portions disposed on the surface of the n-type semiconductor layer in each of the structured portions as claimed in independent claim 1.

Also, Sano et al. do not disclose that the inclined side surfces of the structured portion are defined by first side surfaces and second side surfaces, a width of each of the first side surfaces increases from a lower surface side to an upper surface side, and a width of each of the second side surfaces increases from the upper surface side to the lower surface side as claimed in independent claims 29 and 45.

It is therefore respectfully submitted that Krames, Kato et al., Okazaki, Okuyama et al., Thibeault et al., Steigerwald et al., and Sano et al., individually or in combination, do not teach, disclose or suggest the presently claimed invention and it

would not have been obvious to one of ordinary skill in the art to combine these references to render the present claims obvious.

In view of foregoing claim amendments and remarks, it is respectfully submitted that the application is now in condition for allowance and an action to this effect is respectfully requested.

If there are any questions or concerns regarding this amendment or the remarks, the Examiner is requested to telephone the undersigned at the telephone number listed below.

Respectfully submitted,

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